# Red Tree Vole Conservation Plan Briggs Creek Fifth-field Watershed

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# I. Summary

The red tree vole (RTV) conservation plan described herein was developed consistent with the High Priority Site Management Recommendations for the Red Tree Vole (*Arborimus longicaudus*; hereafter, RTV) Version 1.0 (Huff 2016, hereafter HPS MR), to provide a reasonable assurance of RTV persistence within the Briggs Creek fifth-field watershed located entirely within Josephine County, Oregon. The goal of the plan is to identify national forest lands (USDA Forest Service) that would be managed to provide suitable habitat for a well distributed population of red tree voles and allow linkages to adjacent watersheds. The conservation plan covers approximately 23,442 acres (57 percent) of National Forest lands in the watershed. This document describes how the conservation plan meets the rule set from the HPS MR and ultimately provides a science-based conservation strategy for RTV persistence.

Upon plan approval through the final decision document for the Upper Briggs Creek Restoration Project, all national forest lands within the 5$^{th}$-field watershed would be designated in one of four categories as follows:

1) **LUA-RTV - Areas managed consistent with RTV conservation** within reserve land use allocations such as late-successional reserves (LSR), 100-acre LSRs, National Wild and Scenic Rivers (wild river), large riparian reserves and 70-acre northern spotted owl nest patches. No activities would occur in these areas which would trigger pre-disturbance surveys for RTV.

2) **HPS –high-priority sites** designated for RTV conservation overlap other land-use allocations including riparian reserve, special wildlife sites, matrix and botanical areas. No activities would occur which trigger pre-disturbance surveys for RTV in these HPS.

3) **Connectivity Areas** include small riparian reserves not identified as LUA-RTV and additional habitat corridors in between HPS and LUA-RTV. These areas are at least 300 feet wide and would not likely provide long-term occupancy by a red tree vole population but would provide dispersal habitat to larger patches of habitat. Management of these connectivity areas would not trigger pre-disturbance surveys for red tree voles.

4) **Non-HPS - Non-high priority sites** are remaining areas not designated as LUA-RTV, HPS or connectivity areas and would not be designated for RTV conservation. Pre-disturbance RTV surveys and/or site protection buffers would not be required in this designation.

In addition, some areas have been identified as "Survey Areas" where pre-disturbance surveys and known site management would continue because there currently is not enough suitable habitat and connectivity to meet the ruleset used to provide a reasonable assurance of red tree vole persistence in those areas.

# II. Background

## Purpose of Document in Relation to Management Direction

Red tree voles are considered a category C survey and manage species under the Northwest Forest Plan, for which the objective is to "[i]dentify and manage high-priority sites to provide for reasonable assurance of species persistence. Until high-priority sites can be determined, manage all known sites (USDA Forest Service and USDI Bureau of Land Management 2001, Standards and Guidelines p 10). Mitigation prior to establishing high-priority sites requires pre-disturbance surveys and a minimum 10-acre habitat protection buffer surrounding one active or assumed active nest tree located during surveys, with sites incrementally growing depending on the number of nests located (USDA Forest Service and USDI Bureau of Land Management 1994, 2001).

The HPS MR for red tree voles transmitted to field units in May 2016, outlines a process to develop a conservation plan intended to provide a reasonable assurance of species persistence in one or more fifth-field watersheds (Huff 2016). Furthermore, the conservation plan must be included in project-level National Environmental Policy Act (NEPA) analyses conducted by the District. Upon plan approval, areas within the watershed(s) and under Forest Service management designated as non-high priority sites will no longer require surveys prior to habitat-disturbing activities nor site or habitat protection because they are not considered as habitat necessary to provide for a reasonable assurance of red tree vole persistence (Huff 2016; USDA Forest Service and USDI Bureau of Land Management 2001).

The conservation plan described within this document (hereafter "RTV Plan") provides a reasonable assurance of red tree vole persistence and a science-based conservation strategy. This RTV Plan documents application of the rule set provided in the HPS MR within the Briggs Creek watershed on National Forest System land managed by the Wild Rivers Ranger District. This watershed is located in southwest Oregon, and entirely within the southern portion of the red tree vole's range (blue shaded area directly below the word "Survey" in "Xeric Survey Range" in Figure 1).

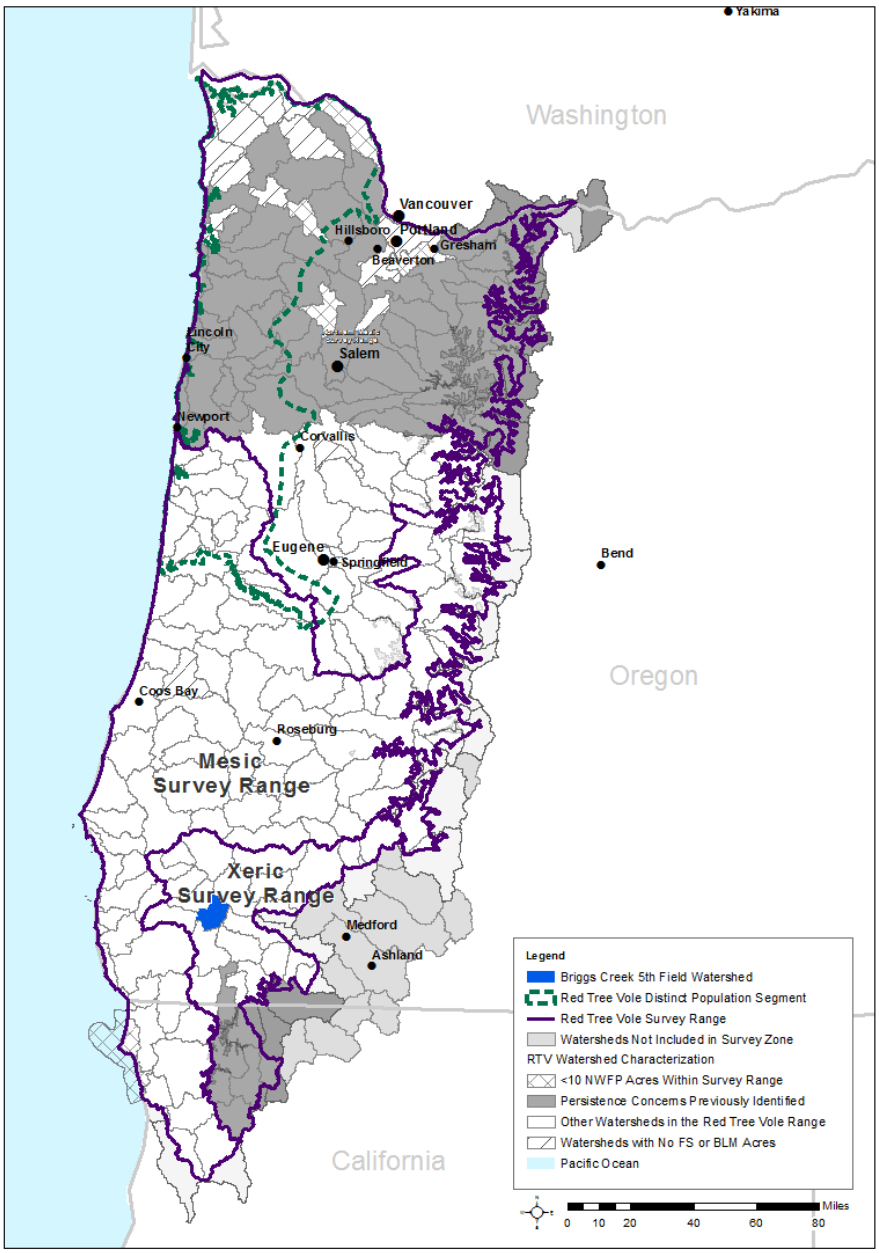


Figure 1. Location of Briggs Creek watershed (blue) within the range of the red tree vole. The watershed is in the xeric survey range and is a watershed characterized with no persistence concerns previously identified.

## Summary of Rule Set Used in Developing the RTV Plan

The rule set described by Huff (2016) is aimed at providing a well-distributed, interconnected populations of red tree voles throughout federally managed lands in fifth-field watersheds. The key objective is to provide suitable habitat for species persistence within the watershed and allow movement (hereafter "connectivity") of red tree voles within the watershed and into adjacent watersheds. The Briggs Creek watershed is divided between reserve land-use allocations in the southwest and matrix with riparian reserves in the northeast (Table 1, Figure 2; USDA Forest Service and USDI Bureau of Land Management 1994). The RTV Plan includes reserve land-use allocations managed consistent with red tree

vole conservation, and high priority sites that include portions of matrix, riparian reserve and administratively withdrawn allocations per the Rogue River-Siskiyou National Forest Land and Resource Management Plan (USDA Forest Service 1989) as amended by the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994). The rule set requires identification of the following elements, taken from Huff (2016:14):

1) Land-use allocations managed consistent with red tree vole conservation;
2) High-priority sites outside of those areas;
3) Connectivity areas linking sites and land-use allocations managed consistent with red tree vole conservation and linking adjacent watersheds;
4) Non-high priority sites where pre-disturbance surveys and site management are no longer required;
5) Information gaps;
6) New information that would trigger revision of the RTV Plan.

The general rules below are described in the HPS MR and guide development of the RTV Plan.

1) Portions of land-use allocations managed for red tree vole conservation should not include areas whose management would trigger pre-disturbance surveys for red tree voles;
2) The larger the area for red tree vole conservation, the greater flexibility allowed for the composition of the site regarding stand ages. Large is defined as >25 acres, and areas identified for red tree vole conservation should be >10 acres;
3) Young forests (forest stands 20–80 years) may be included in some situations for red tree vole conservation areas;
4) Conservation areas should be well-distributed within the watershed, including the edge of the watershed;
5) Conservation areas should consider connectivity for vole populations and be comprised of suitable habitat as possible;
6) Connectivity corridors should be ≥300 feet wide and long and ≥5 acres, and non-forest openings in areas for connectivity should be <100 feet;
7) Connectivity to adjacent watersheds must link to areas within the adjacent watersheds that provide for red tree vole persistence.

# III. Data and Models Used in Designing the Plan

## Evaluation of Frequency of Occurrence

Recent publications that evaluate the distribution of red tree voles in Oregon and Washington have differing conclusions for the Briggs Creek watershed area depending on the scale of analysis and sample data. Rosenburg et al (2016) provides a broad evaluation of potential distribution of red tree voles based on 2001–2004 survey data collected from randomly selected 1 ha plots throughout the species range, stratified on stand age class (Rittenhouse et al. 2002, Dunk and Hawley 2009, Forsman et al. 2016, Rosenberg et al. 2016). This study evaluated relative occurrence patterns at three broad spatial scales 1) physiographic provinces using subregions described by Forsman et al. (2016), 2) delineations of the mesic, north mesic, and xeric survey zones (Huff et al. 2012), and 3) density contours (Rosenberg et al. 2016). These density contours were based on the distribution of 95 RTV home ranges to model population distribution throughout the species range of Oregon. Of the subregions described by Forsman et al., Briggs Creek falls within the interior southwest (Josephine and Jackson counties) which has the lowest occurrence rate of the subregions at 7 percent. Briggs Creek is within the xeric survey zone which

has the lowest occurrence rate of the survey zones at 13 percent, compared to 37% and 28% in the mesic and north mesic zones respectively (Rosenburg et al. 2016). Finally, the Rosenburg et al 2016 analysis placed Briggs Creek within the 80 percent density contour with a 19 percent occurrence rate as compared to the 20 percent density contour with a 60 percent occurrence rate (the highest of all the density contours). However, within that 80 percent contour, Briggs Creek lies in one of two areas with the highest concentrations of detections. Furthermore, additional data about red tree vole distribution evaluated in Forsman et al 2016 including owl pellet analysis and survey data collected from 1990-2013 found red tree voles to be relatively common in the diet of northern spotted owls in Josephine county and upon evaluation of all available survey data, it was concluded that "tree voles in Oregon are most abundant and most evenly distributed in the central and southwestern portion of western Oregon and are uncommon or rare in the northern Coast Ranges and northern Cascades…" (Forsman et al. 2016 p 36). They also conclude that tree voles may be able to recolonize harvested areas from adjacent refugia for the first few rotations, however their persistence in areas with shorter rotations and frequent thinning is less hopeful (Forsman et al. 2016 p 39). The fires of 2017 (Chetco Bar) and 2018 (Taylor Creek and Klondike) resulted in loss of habitat suitability for several known red tree vole nest sites and thousands of acres of suitable habitat on the Siskiyou portion of the Rogue River-Siskiyou National Forest. It is unknown how continuous exposure to smoke and heat during these fires affected red tree voles. This RTV plan has been revised to account for the effects to habitat from the Taylor Creek and Klondike fires that burned within the Briggs Creek watershed.

## Evaluation of Habitat Suitability

The HPS MR allows for assessment of suitable habitat through modeling approaches (Huff 2016 p 14). Habitat models provide an appropriate approach for assessing large areas for conservation planning and a means for including areas where tree voles may be present but not detected or where they may be absent because suitable habitat may not be presently occupied (Rosenberg et al. 2016).

This RTV Plan uses the 2012 gradient nearest neighbor (GNN) vegetation data (Oregon State University (http://www.fsl.orst.edu/lemma/) updated by burned area reflectance classification (BARC) fire severity data for the 2014 Onion Mountain fire, and Sentinel-RAVG (rapid assessment of vegetation condition after wildfire) fire intensity data for the 2018 Taylor Creek and Klondike fires to identify suitable habitat using the Van Norman 2014 (unpublished meeting notes) description of red tree vole non-habitat; 1) non-forest areas (eg. >90% basal area loss from fire, rock outcrops, etc.), 2) stands with no Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*) or Sitka spruce (*Picea sitchensis*), 3) stands of any age with <60 percent canopy closure, and 4) stands <20 years old (Huff 2016, p 14).

Areas that burned with high intensity according to the BARC data for the Onion Mountain fire are considered non-habitat. The Sentinel RAVG data measured fire intensity in increments of basal area loss. For the Klondike and Taylor Creek fires, areas mapped with >50% basal area loss are considered non-habitat. Areas with 26–50% basal area loss that had <80 percent canopy cover prior to the fire, are also considered non-habitat, while Douglas-fir stands with ≥80 percent canopy cover prior to the fire with 26–50% basal area loss are still considered suitable habitat. The latter accounts for about 2,500 acres in the watershed that may still provide habitat. All remaining Douglas-fir stands with >60 percent canopy cover, quadratic mean diameter of >10 inches, and <25 percent basal area loss from the fire are considered suitable habitat. The quadratic mean diameter of 10 inches was suggested by the district silviculturalist (Rob Barnhart, pers. comm.) as an acceptable proxy for tree age >20 years old for this watershed though it is variable based on site productivity. This query produced a reasonable estimate of approximately 18,785 acres of existing RTV habitat on national forest lands in the watershed when compared to aerial imagery and field verification.

### Tree Vole Surveys

For development of this RTV Plan, a set of previously collected red tree vole pre-disturbance survey data within and surrounding the watershed were used to compare the GNN habitat to known nest site locations (Van Norman 2014). Pre-disturbance surveys for various projects were conducted in Briggs Creek watershed and within 2 miles outside the watershed between the years 2000–2010. A total of 248 active and inactive nests were found within 2,732 acres of surveys in this area. However, these known nest locations within the Briggs Creek watershed do not represent a random sample across the watershed, and is biased because survey areas were selected based on specific habitat descriptions within proposed project locations; nearly all of them were conducted in stands >60 years in age having large legacy conifer trees with dense young Douglas-fir, and were focused within 5 contiguous square miles (5 sections) of the 68 square mile watershed. The surveys covered 6 percent of the entire watershed and 10 percent of the suitable habitat in the watershed. Therefore, these pre-disturbance survey data bias our understanding of red tree vole habitat preference and potentially affect conclusions about available suitable habitat within the 5$^{th}$ field watershed. All surveys were conducted within matrix, riparian reserve and special wildlife site land-use allocations. Of the 248 nests, 32 are in areas that burned with >50 percent basal area mortality, 27 of which are in the Briggs Creek watershed. Eleven additional sites in the Briggs Creek watershed are in areas with 26–50 percent basal area mortality. The current status of site occupancy for all of these sites is unknown.

## IV. Biological Background

### Vegetation Patterns and Environmental Conditions

The Briggs Creek watershed occurs in the Oregon portion of the Klamath physiographic province, characterized by diverse mixed-conifer hardwood forest types. Elevation ranges from 840-4600 feet. Annual average precipitation is variable in the watershed ranging from 48–94 inches based on 30 year normal annual precipitation data from parameter-elevation regression on independent slope models (PRISM) at 800 m resolution with most precipitation occurring in November and December. Summers are dry and hot, typical of the Klamath Mountains province which together with soil properties, contribute to xeric conditions that give rise to the Klamath mixed conifer-hardwood forest type. The watershed contains large areas of serpentine soils, another factor contributing to floral diversity and open mixed pine and shrub forest types, though limiting to red tree vole habitat distribution. The watershed is prone to frequent fires, which historically maintained more open canopy and woodlands consisting of oak (Oregon white oak, *Quercus garryana*; California black oak, *Q.* kelloggii; and mixed pine dominated stands. Mixed pine stands include sugar pine (*Pinus lambertiana*), knobcone pine (*Pinus attenuata*), incense cedar (*Calocedrus decurrens*), western white pine (*Pinus monticola*), Jeffrey pine (*Pinus jeffreyi*), and Douglas-fir. Figure 3 displays the distribution of large fires that have burned in the last 16 years in the watershed. The Taylor Creek and Klondike fire RAVG fire intensity data based on satellite imagery shows 68 percent of the Briggs Creek watershed had no basal area loss. In other words, at least 68 percent of the watershed burned with some level of vegetation mortality visible from satellite imagery which is reasonably accurate based on field observations, but actually underestimates low intensity burned areas where the understory burned, leaving the overstory intact. Furthermore, shallow soils with low water storage capacity are prevalent in the Briggs Creek watershed (Figure 4) and may limit long-term availability of high density Douglas-fir stands exposed to periodic drought and wildland fire. The combination of wildfire and serpentine and shallow soils may be causing habitat isolation between Briggs Creek and surrounding watersheds which is evident in the current suitable habitat distribution (Figure 5).

### Distribution of Red Tree Vole Habitat

Approximately 44 percent of national forest land in the watershed is mapped as suitable red tree vole habitat per the GNN data (Table 1; Van Norman 2014). This is likely an underestimate of habitat in this particular watershed based on the red tree vole survey results because 89 of 248 (36%) known red tree vole nests were located in what would be modeled non-habitat based on GNN data (Van Norman 2014), many of these areas are mapped with 40-60 percent canopy closure and likely provide low-contrast habitat that may increase the footprint of dispersed patches of old forest enhancing metapopulation function (Linnell et al. 2016).

Primary factors that limit red tree vole habitat distribution in the Briggs Creek watershed are recently burned areas, serpentine geology, and shallow soils which limit conifer density and do not provide highly suitable habitat for tree voles. The entire watershed has experienced recent fire, though much of it was low intensity where only the understory burned. Habitat connectivity is nearly non-existent on the west and south ridgelines which are largely serpentine and have experienced fire at least twice in the last 15 years.

Serpentine soils cover approximately 16 percent (6,689 acres) of national forest lands in the watershed (Figure 3; Table 1). Douglas-fir, pines, and incense cedar dominate the overstory of unburned serpentine areas, however canopy cover is typically <60 percent except in moist drainages and areas with deeper soil that are adjacent to suitable habitat on non-serpentine soil.

Shallow soils with low water storage capacity also influence Douglas-fir forest development in the watershed by limiting sustainability of dense canopies especially during prolonged periods of drought, especially on south-facing slopes. Figure 4 displays the soil depth data for the watershed. Suitable habitat in shallow soils is concentrated along stream drainages, while the majority of suitable habitat in the watershed is associated with deeper soils (Figures 4 and 5).

Past logging and establishment of plantations created a patchwork of young forest stands (<40 years old) that disrupt suitable habitat connectivity in some areas of the watershed, though red tree voles are known to occupy small remnant patches of suitable habitat in young forest and even disperse through less suitable habitat (Forsman et al. 2016). The lack of suitable foundations (complex branch and bole structure) upon which red tree voles build nests, likely limits the suitability of young forest for red tree vole habitat (Foresman et al. 2016; Linnell et al. 2018). Thirty percent of approximately 8,200 acres of managed stands (all ages) in the Briggs Creek watershed burned with >50 percent basal area loss in the 2018 Taylor Creek and Klondike fires.

## V. Conservation Plan: Approach

This RTV Plan was developed with an iterative process which included consultation with Forest, Regional staff, and Pacific Northwest Research Station. The initial step was to (1) develop maps of federal land-use allocations and identify allocations that are managed consistent with RTV conservation, (2) identify non-federal lands, (3) identify areas of serpentine soils, (4) identify recently burned areas, and (5) develop maps of habitat suitability based on GNN data and the Van Norman 2014 description of non-habitat.

The second step incorporated aerial imagery and on-the-ground verification of habitat suitability to evaluate habitat extent and connectivity within the Briggs Creek watershed, and delineate high priority site locations and connectivity areas within the watershed but outside of lands managed consistent with red tree vole conservation per pages 16–20 of the HPS management recommendations.

The third step was to evaluate connectivity between Briggs Creek watershed and adjacent fifth-field watersheds. Aerial image interpretation, GNN vegetation information, RAVG fire intensity mapping and on-the-ground knowledge were used to identify areas of "inter-watershed" connectivity (HPS MR pp 20–23).

# VI. Conservation Plan: Strategy

## Overview

The Briggs Creek RTV Plan includes all land-use allocations consistent with red tree vole conservation and six 70-acre northern spotted owl nest patches which comprise approximately 52 percent of national forest lands in the watershed (Figure 2; Table 1).

Twenty-two high priority sites were identified to provide additional habitat for red tree vole conservation outside of reserve land-use allocations in the Briggs Creek watershed. These high priority sites (HPS) cover approximately 764 acres and would be managed consistent with red tree vole conservation. All HPS were evaluated for conflicts with other management objectives. Since suitable habitat for RTV coincides with suitable nesting, roosting foraging habitat for northern spotted owls, management objectives would normally maintain spotted owl habitat function in these areas anyway.

Furthermore, smaller riparian reserves that are managed consistent with red tree vole conservation and can provide habitat connectivity between HPS and reserved land-use allocations. These are not included as LUA-RTV because they are considered too small to support long-term red tree vole persistence, but are included as connectivity corridors where they have enough suitable habitat to support dispersal between larger patches of suitable habitat. Approximately 1,061 acres of small riparian reserves are not included in connectivity corridors because the 381 acres of suitable habitat within them is sparse or isolated and would not likely support dispersal to larger patches of suitable habitat (Table 1).

Approximately 7,898 acres of the watershed where fire has resulted in highly fragmented patches of habitat were left out of the RTV Plan and would require pre-disturbance surveys per the red tree vole survey protocol (Table 1). These areas are identified in Figure 6 as "Survey Areas".

## Land-Use Allocations Managed Consistent with RTV Conservation (LUA-RTV)

Late-successional reserve (LSR), wild river, and riparian reserves on large perennial streams are the only land-use allocations with management standards and guidelines consistent with red tree vole conservation that would support long-term red tree vole persistence in the Briggs Creek watershed (Figure 2). This management allows activities that do not trigger pre-disturbance surveys such as thinning stands <80 years in age. Most LSR is in the southern portion of the watershed. The northern portion of the watershed has 126 acres of "100-acre" LSRs and 400 acres of northern spotted owl nest patches (300 m buffer of an activity center) outside of the larger LSR. Riparian reserves are intended to not only provide habitat for aquatic and riparian dependent species, but also provide connectivity corridors between LSRs (NWFP ROD 1994: B-13). Collectively, 21,662 acres (52 percent) of Federal lands in Briggs Creek watershed is LUA-RTV and is primarily located in the southwest portion of the watershed (Fig. 6). Other administratively withdrawn allocations such as botanical areas and special wildlife sites may not be entirely managed consistent with red tree vole conservation depending on habitat objectives for the site (eg. the Horse Creek Meadow wildlife site includes meadow and hardwood habitats that would benefit deer, elk and many other species) and are not included in LUA-RTV.

Approximately 10,408 acres (48 percent) of LUA-RTV is comprised of suitable habitat (Table 1). Most early seral stands (<20 years old) within LUA-RTV are a result of recent fires and are managed consistent with red tree vole conservation but will likely not be of use to tree vole until Douglas-fir in the forest

reach 20 years old. In the long-term, these stands are expected to contribute to red tree vole persistence in the Briggs Creek watershed as they mature. Approximately 86 percent of LUA-RTV is expected to provide existing or future habitat for red tree voles. The remaining 14 percent has serpentine geology, most of which is unsuitable habitat described earlier, and likely provides only limited connectivity. However, moist north aspects and drainages within this area of serpentine geology may support stands of Douglas-fir that provide suitable habitat where it is adjacent to non-serpentine habitat. Most of this area is in the LSR (Table 1, Figures 4, 5 and 6).

## High Priority Sites (HPS)

Twenty-two HPS (mean ± standard deviation = 35 ± 20; range = 11–104 acres) were delineated to provide patches of suitable habitat outside of LUA-RTV and contribute to a reasonable assurance of red tree vole persistence in the watershed (Figures 6 and 7). HPS contribute to species persistence by providing areas large enough for red tree vole life requirements and their placement on the landscape and connections to other HPS or LUA-RTV provide redundancy on the landscape in face of stochastic events, such a large stand-replacement wildfires. These sites were delineated from aerial imagery, habitat mapping, and on-the-ground knowledge using guidelines on pages 16–20 in the HPS management recommendations. They include stands in matrix, riparian reserve, special wildlife sites, and botanical areas. Some are located at ridgelines to provide connectivity with habitat in neighboring watersheds. They contain approximately 638 acres of suitable habitat (Table 1). Table 2 and Figure 7 provide more detailed information about the habitat and topographic characteristics of individual HPS. Care was taken to minimize the amount of unsuitable habitat in these sites, however, some have small gaps from roads, high fire intensity or other non-conifer features within these larger patches of habitat. All sites either contain known RTV nests or are likely occupied by red tree voles because they have similar habitat as known nest locations within the watershed. HPS are distributed ≤1 km from each other or an LUA-RTV area, and are connected by suitable habitat delineated in connectivity corridors (Figures 6 and 7).

## Connectivity within the Watershed

Approximately 768 acres of suitable habitat are included within 1,016 acres of connectivity corridors delineated to provide habitat connectivity in between HPS and LUA-RTV (Table 1, Figures 6 and 7). These include small riparian reserves and additional land-use allocations.

Some parts of the watershed, particularly in the southeast and northwest do not have enough contiguous habitat to provide adequate connectivity to larger patches of habitat. These areas are also fragmented by serpentine soils or private lands. Therefore, they are not included in the RTV Plan and would require pre-disturbance surveys (Survey Areas, Figure 6).

## Connectivity to Adjacent Watersheds

Identification of habitat connectivity to adjacent watersheds was based on 1) adjacency of reserve areas outside of the Briggs Creek watershed that included suitable habitat and 2) linkages of existing suitable habitat between watersheds. These connectivity areas are primarily extensions of riparian reserves ≥300 feet wide to reach the top of the watershed where habitat exists in the adjoining watershed. Specifics of connectivity to adjacent watersheds are detailed below. Habitat in adjacent watersheds is not included in this RTV Plan.

The habitat map (Figure 5) shows limited post-fire habitat connectivity across the ridgeline with the Josephine Creek-Illinois River watershed to the south, which is also within the LSR (Figures 2 and 5). Connectivity also appears limited with the Klondike Creek-Illinois River watershed. A small amount of habitat still exists where the LSR crosses the ridgeline and would be managed consistent with red tree vole conservation in the long-term. Likewise, there is limited habitat connectivity across the ridgeline

with the Deer Creek watershed. The habitat condition in this south portion of the Briggs Creek watershed does not provide opportunities to delineate HPS or connectivity corridors that meet the spacing and habitat contiguity requirements in the ruleset which is why they are identified as areas that would require pre-disturbance surveys.

In addition, LSR in the Hellgate Canyon-Rogue River watershed is adjacent north of the Briggs Creek watershed. A combination of connectivity areas, HPS and LUA-RTV are delineated in this plan to provide habitat connectivity with that LSR. A small area near Onion Mountain with limited habitat connectivity in the Hellgate Canyon-Rogue River watershed is identified for pre-disturbance surveys.

The ridgeline with the Silver Creek watershed to the west is predominantly serpentine and burned in the Biscuit fire and in the Klondike and Taylor Creek fires. For these reasons, little habitat or connectivity exists on or near the ridgeline and the area has a low likelihood of providing suitable habitat for red tree voles for decades.

A high-use paved road on the east ridgeline shared with the Lower Applegate River watershed may inhibit dispersal, however connectivity areas and HPS delineated along this ridgeline contain some of the heavier tree canopy available next to the road and across the ridgeline.

In summary, habitat connectivity from the Briggs Creek watershed into adjacent watersheds is limited to the north and east sides of the watershed due to lack of suitable habitat as a result of recent fire and serpentine influence along the south and west sides.

## Relationship of Known Red Tree Vole Sites to High Priority Sites

Of 1,834 acres surveyed within the Briggs Creek watershed, 196 red tree vole nests were found (96 active, 91 inactive, 8 unknown). These surveyed acres are outside of LSR and comprise 4 percent of national forest lands in the watershed. Given this density of nest trees within 7 percent of the habitat in the watershed prior to the 2018 fires, it is presumed that red tree voles were fairly well distributed throughout the watershed. Of the 196 nest trees, 27 were located in areas that burned with ≥50 percent basal area loss and are assumed to be unsuitable. Seventy of the remaining nest trees are within HPS and 28 are included in LUA-RTV, of these 98 sites, 46 were confirmed active when they were found. This leaves 71 nest trees that are not within an HPS or LUA-RTV, 47 of which are in matrix and 24 within land allocations that are not managed for timber production.

## How this Plan Meets the High Priority Site Management Recommendations Rule Set

This RTV Plan (Figure 6) meets the HPS MR by providing well-distributed habitat that will be managed consistent with red tree vole conservation and provide for connectivity within the watershed and between adjacent watersheds. Forty-nine percent of the entire Briggs Creek watershed is in LUA-RTV and an additional 4 percent in connectivity areas and HPS combined would result in 53 percent of the entire watershed managed consistent with red tree vole conservation (56 percent of national forest lands, Table 1). In addition, 19 percent of remaining national forest lands would be subject to pre-disturbance surveys for red tree voles should future management be planned in suitable habitat in those areas (Table 1). Pre-disturbance surveys and site management in accordance with established protocols would provide for a reasonable assurance of species persistence in those portions of the watershed. Therefore, approximately 75 percent of national forest lands in the watershed would be managed consistent with red tree vole conservation.

The following section addresses how the RTV Plan meets each rule, in numerical order, as described by Huff (2016:17–23). The tables and figures at the end of the document provide additional details that relate to these rules.

## A. Land-use allocations managed consistent with red tree vole conservation (LUA-RTV)

Late-successional reserve and large perennial stream riparian reserves (>600 ft wide) are the land-use allocations identified as managed consistent with red tree vole conservation in the watershed. In addition, the six 70-acre owl nest patches are also managed consistent with red tree vole conservation in that very limited treatment that would not change stand structure may occur (eg. road and roadside fuel maintenance: manual understory vegetation cutting, piling, burning) but usually no treatments are allowed in these areas. In addition a small amount of wild river is managed consistent with RTV conservation in the watershed. These LUA-RTV areas combined comprise 49 percent of the entire Briggs watershed (Table 1). Activities in these areas would not trigger the need for red tree vole pre-disturbance surveys.

## B. High priority sites (HPS)

**1. Composition of high priority sites**

(a) *Choose stands containing Douglas-fir*: all high priority sites are dominated by Douglas-fir verified by GNN habitat data as suitable habitat, aerial imagery, and field verification.

(b) *Choose stands with large trees present,* (c) *Choose old-growth forest conditions when available*: sites were delineated around existing patches of the largest trees available using aerial imagery. These are typically correlated with NSO nesting, roosting, foraging habitat which captures old-growth and the most dense mature forest habitat in the landscape.

(d) *Select HPS that are relatively unfragmented with little edge habitat*: sites were delineated around contiguous stands of mature forest to the extent possible using aerial imagery and GNN suitable habitat data, some contain small amounts of road or young forest stands or burned areas;

(e) *Select stands with higher canopy closure*: sites were delineated around stands with >60 percent canopy cover to the extent possible using GNN suitable habitat data and aerial imagery;

(f) *The larger the HPS, the more flexibility in the composition of the site*: most sites are composed of stands with the largest and highest density Douglas-fir in the area. Some larger sites were delineated to include more habitat where young forest stands or areas with lower canopy cover could not be avoided; others are larger to include several known nest locations, meet spacing requirements and are entirely suitable habitat.

(g) *In some areas it may be appropriate to select young unthinned forest (>20 years old) as HPS. This may be necessary based on spacing rules and connectivity needs,* (h) *Habitat quality of young forests may increase with large old legacy trees and higher canopy closure and* (i) *Small patches of forest can sometimes act as refugia for tree voles and should not be discounted especially in a landscape deficient in habitat*: We included as much mature forest in the HPS as possible, some of the larger HPS contain young forest >20 years old that connect patches of more mature forest within the HPS or with connectivity areas.

(j) *Choose sites that are within more resilient stand types or are less prone to disturbance. Where possible, choose sites with stand conditions that may render the sites more resilient to ecological pressures, tree disease, insects, fire and windstorm events, to encourage longer term persistence of those sites:* Sites were primarily delineated in drainages with large Douglas-fir. As described earlier in this document, soil depth, and water holding capacity is better on these sites which can sustain denser stands of fir in the long term. The HPS do include habitat with somewhat proven resilience since they have survived recent fires.

**2. Size of high priority sites**

*(a) HPS should be ≥10 acres, with size increasing relative to the number of nests within the site*. *(b) Each HPS should be sized to provide acreage for a number of non-overlapping home ranges to ensure interaction among voles*: All HPS are >10 acres and average ± standard deviation = 35 ± 20 (range = 11–104 acres. HPS that contain many known nest trees are much larger than 10 acres and most are adjacent to additional suitable habitat within LUA-RTV.

*(c) Consider designating larger sites ≥25 acres to build in site resiliency, which is particularly important in parts of the species' range where fire plays a significant role and (d) Consider varying HPS size based on proximity to larger land-use allocations managed for red tree vole conservation.* Fifteen of the 22 sites range from 26–104 acres to allow for site resiliency in locations farther from LUA-RTV. Smaller sites are directly adjacent to suitable habitat within connectivity areas and within shorter distances of larger sites or LUA-RTV.

*(e) The lesser the amount of larger land-use allocations managed consistent with red tree vole conservation within the watershed, the greater the need for larger (≥25 acres) HPS:* Almost half of the watershed is LUA-RTV with most of that being one contiguous LSR in the southwest portion of the watershed. Of the 22 HPS, 15 are ≥25 acres. Where HPS and connectivity placement could not meet the rule set, these areas are identified to continue to implement pre-disturbance surveys prior to habitat-disturbing activities. This accounts for 19 percent of the watershed.

**3. Location of high priority sites**

(a) *Locate sites to provide well-distributed populations and habitat within the watershed*. Sites were located within 1 km of each other or LUA-RTV with connectivity areas that also provide habitat and incorporate much of the best habitat available outside of reserve land allocations. (Figure 7).

(b) *Designate sites at or near the edge of the watershed or the outer boundary of the range of the species*: The watershed is in the middle of the Xeric survey zone of the species. Some HPS were located at ridgelines where habitat linkages are apparent in drainages on both sides of the ridge.

(c) *HPS do not need to be located within those land-use allocations managed consistent with red tree vole conservation, as management of these areas should not conflict with red tree vole site persistence*: HPS are not located within LUA-RTV.

(d) *Ensure high-priority sites are in a diversity of conditions to safeguard the persistence of multiple sites within the watershed. If sites are selected in more disturbance-prone or climate change predicted areas, select more sites to provide redundancy in the face of potential site loss. (eg. consider fire risk and climate change models, wildland-urban interface where vegetation management to reduce fire risk may impede red tree vole persistence, assess other hazard, debris flow and wind damage potential):* The entire landscape is a fire-adapted ecosystem with frequent fire return intervals. However, most high priority sites are located in riparian areas and north-facing slopes which tend to be less fire-prone due to higher moisture and less sun exposure than other aspects. Some sites are located on south aspects or ridgelines in order to provide linkages or larger patches of habitat in more isolated areas. Redundancy was achieved by multiple high priority sites with connectivity across ridgelines between different stream reaches with consideration for vegetation management objectives to reduce fire risk (eg. roadsides, ridgelines preferred for fire control or containment to prevent fire spread onto private lands, dense stands on shallow soils/south aspects with high drought and fire susceptibility).

(e) *Consider whether other rare species may be present at the site and would benefit from the site being protected:*

HPS include nesting, roosting, and foraging habitat for northern spotted owls. Attention was also given to avoid locations where vegetation management for other species habitat needs would not be in conflict with red tree vole conservation (eg. meadow and early seral habitat for pollinators and ungulates, open habitat for rare plants, pine-oak habitat for woodpeckers, ungulates, fisher, etc.) which are included in some of the special wildlife site land allocations.

(f) *Location of high-priority sites is strongly dictated by connectivity needs. Determine where larger roads, rivers, recreation areas or other landscape features may limit red tree vole movement:* Avoiding large openings (meadows, rock outcrops, campgrounds, etc) and roads was a primary consideration in locating these sites to avoid barriers to movement to the extent possible.

**4. Number of high priority sites**

(a) *The number of HPS needed in a watershed is variable and dependent on variables such as watershed size, amounts of reserve lands and red tree vole habitat and desired connectivity…There is not an absolute number or formula to determine the number of sites needed*. Twenty-two HPS were located in areas where LUA-RTV is not extensive, and where adequate suitable habitat exists to provide tree vole persistence and connectivity (see Figure 7).

(b) *In portions of the watershed with low amounts of reserve lands, consider multiple lined and sometimes closely grouped HPS to ensure resiliency from stochastic and human caused events:* Though approximately half of the watershed is reserve lands, attention was given to ensure HPS were each linked with 3 connectivity corridors within 1km to other HPS or LUA-RTV to increase resiliency. Groupings were used to meet distance requirements and provide redundancy in areas away from large amounts of LUA-RTV where suitable habitat is available.

(c) *The number of HPS in a watershed may vary based on the size of the HPS designated. For instance, a larger number of smaller-sized HPS may be needed compared to a smaller number of larger-sized HPS within the same area.* Fifteen of the 22 HPS are considered large HPS >25 acres. HPS sizes range from 11–104 acres depending on proximity to LUA-RTV, distance between known sites and distribution of suitable habitat.

(d) *In certain situations, existing land-use allocations and standards and guidelines alone may be adequate in providing for red tree vole populations within the watershed and no high-priority sites are needed.* Existing reserve land-use allocations are not evenly distributed in this watershed, and there was a need for HPS in the north and east portions of the watershed.

## C. Connectivity

Connectivity in the RTV Plan is largely achieved by riparian reserves with large amounts of Douglas-fir that provide suitable or low-contrast habitat for tree voles. Connectivity areas were also added as extensions of riparian reserves to provide connectivity between HPS and across watershed ridgelines.

**1. Composition of corridors or patches managed as connectivity areas**

(a) *Although continuous canopy is preferred in connectivity areas, canopy gaps or non-forest openings within corridors or patches can be included but should be <100 ft.* and (b) *Young forests can provide connectivity,* and (c) *Where there is little old forest available as connectivity areas, select forested links that can provide a sheltered environment for red tree voles:* Most connectivity corridors have continuous suitable habitat with no gaps >100 feet. However, where there are gaps >100 feet within some corridors,

they were made wider to provide continuous habitat around the gaps. Many of these gaps actually contain forested habitat with 40–60 percent canopy cover.

**2. Width of corridors and size of landscape patches**

(a) *Connectivity corridors should be ≥300 feet in width* and (b) *Landscape patches managed for connectivity should be ≥300 feet wide and long, and ≥ 5 acres in size:* Connectivity corridors are >300 feet wide and include small riparian reserves and additional habitat to increase habitat connectivity around gaps. In a few cases the gaps contain forested habitat with 40–60 percent canopy cover and is the only forested habitat available. Landscape patches were not used for connectivity in this Plan.

(c) *Riparian reserves can be widened to accommodate red tree vole dispersal*: Riparian reserves have been widened in many cases to provide contiguous habitat within the connectivity corridors.

(d) *The wider the area or larger the patch managed for connectivity, the greater the flexibility in management of the stands in the connectivity areas. Including young forest in corridors or patches that are larger than the rule set dictates could allow for the thinning of those stands to promote red tree vole habitat.* Many connectivity corridors are wider to capture continuous suitable habitat around gaps or areas with lower canopy cover. Any management activities in these corridors to promote RTV habitat would be consistent with RTV conservation.

**3. Location of connectivity areas on the landscape**

(a) *Connectivity may be adequately provided by existing vegetation patterns and land-use allocations within the watershed. Assess where adequate connectivity exists between HPS and LUA-RTV. Assess where adequate connectivity exists to adjacent fifth-field watersheds based on current LUA. For example, watersheds with extensive and larger (≥300 feet wide) riparian reserves may not need additional areas identified for connectivity, if those riparian reserves are managed consistent with red tree vole conservation.* This watershed contains extensive riparian reserves ≥300 feet wide (Figures 2, 6 and 7), that are managed consistent with red tree vole conservation in providing Douglas-fir forest conditions that tree voles can occupy. Additional connectivity areas were delineated to capture continuous habitat where riparian reserves lack habitat due to fire effects, to meet distance requirements between HPS and LUA-RTV, and to provide habitat connectivity across ridgelines to adjacent watersheds.

(b) *Ensure connectivity occurs within the survey zone of the species:* The Briggs watershed is within the red tree vole xeric survey zone below 6,000 feet which is below the survey protocol elevation line, therefore, all connectivity occurs within the xeric survey zone for the red tree vole.

(c) *Select corridors or patches that are potentially more resilient to disturbances and climate change and less likely to be managed for fuel reduction around communities*: Adjacency to private lands, fire prone south aspects and ridgelines where fuel reduction activities may be in conflict with red tree vole conservation were considered when these connectivity corridors and patches were selected. To the extent possible, they are situated in and near riparian areas where existing habitat occurs and site conditions are more resilient to drought stress and fire risk. In many cases, these corridors contain the only connective habitat left after the 2018 fires.

(d) *Utilize maps showing larger roads, rivers, recreation areas, human development, surface mines or other factors that may affect red tree vole distribution and dispersal in the watershed*: Multiple data sources were used to identify possible barriers to RTV distribution and dispersal, including private lands, fuel management zones, road systems, recreation sites, meadows, recent burn intensity, areas of serpentine soils, and aerial imagery.

(e) *In checkerboard ownership, use diagonal linkage to link adjacent blocks, focusing on connecting corners of ownership, identifying HPS, connectivity patches or connectivity corridors*: The Briggs Creek

watershed does not contain extensive checkerboard ownership. However in the south portion of the watershed, where the majority of private lands occur, there is little post-fire habitat left to provide diagonal linkage that meets the ruleset, therefore pre-disturbance surveys would still be required in this area.

(f) *Connectivity to adjacent watersheds must link to areas within the watersheds that provide for red tree vole persistence. This can include LUA-RTV, red tree vole sites, riparian reserve or other areas that currently provide red tree vole habitat.* Location of existing red tree vole habitat, riparian reserves and LUA-RTV within the watershed were the basis of connectivity corridors and HPS locations along the edges of the watershed (Figures 6 and 7) in order to provide connectivity to adjacent watersheds.

(g) *Connectivity to adjacent watersheds can be provided by linking red tree vole habitat to the watershed ridgelines. This can be achieved by delineating connectivity areas, utilizing LUA-RTV, identifying HPS at or near ridgelines, or extending headwater riparian reserves up to the ridgeline.* All of these methods were used to provide connectivity to adjacent watersheds in this plan.

# VII. Non-High Priority Sites (Non-HPS)

All areas of Forest Service management within the Briggs Creek watershed not identified as LUA-RTV, high priority sites, connectivity areas, or areas requiring pre-disturbance surveys are identified as non-high priority sites (Table 1, Figure 6). Non-high priority sites do not require pre-disturbance surveys and any newly discovered red tree vole nests within non-high priority sites would not require site management (Huff 2016). Known red tree vole sites in the non-high priority sites would be released from 10-acre management, however future project design criteria in this watershed would include retention of all known nest trees and including them in treatment skips or areas that would retain conifer canopy connectivity to avoid isolating known nest trees.

In total, non-high priority sites comprise approximately 10,189 acres (25 percent) of national forest lands within the watershed (matrix = 7,214 acres, riparian reserves = 1,061 acres). In addition, about 1,914 acres are backcountry recreation, scenic river, botanical areas and special wildlife sites (Table 1). Based on the GNN habitat data, there are approximately 4,610 acres of suitable habitat in the non-HPS which is 24 percent of the suitable habitat on National Forest lands in the watershed.

# VIII. Management within the RTV Plan Areas

All areas within the Briggs Creek watershed identified as LUA-RTV, high priority sites and connectivity areas will be managed consistent with red tree vole conservation. Such management is expected to continue for the duration of the RTV Plan, as described below. Areas shown outside of the Briggs Creek watershed demonstrate how the RTV Plan connects to adjacent watersheds, but these areas are not covered by the RTV Plan.

The following excerpt is from page 25 of Huff (2016) and describes management that is allowed within land-use allocations managed consistent with red tree vole conservation:

> "Management within these land-use allocations will continue to follow the standards and guidelines within the specific land management plan for the National Forest or BLM District. No activities that would trigger surveys as identified in the survey protocol (Huff, et al. 2012) should occur within these land-use allocations. Young stand management is acceptable; however, the age or structure of the stands proposed for treatment should not trigger the need for pre-disturbance surveys."

If management which could trigger pre-disturbance surveys is planned within LUA-RTV (land use allocation managed consistent with red tree vole conservation) or HPS, then a revision to the RTV Plan would be required (Huff 2016) demonstrating a reasonable assurance of red tree vole persistence. Young stand management is acceptable as described in the excerpt in the previous paragraph.

# IX. Duration of Strategy

The red tree vole plan enacted for the Briggs Creek fifth-field watershed provides management direction for red tree voles in the watershed until updated, replaced or removed through a new project NEPA decision (Huff 2016:24). The expected longevity of the RTV Plan is 15 years.

# X. Identification of Information Gaps

No information gaps were realized during the development of this RTV plan.

# XI. New Information that Would Necessitate a Review of this Conservation Plan

If events occur in which vegetative conditions on the ground would be changed to those areas identified as contributing to red tree vole conservation and they no longer are functioning to provide for red tree vole conservation, then a review and update of this RTV Plan would be needed. An example of an event that would trigger a review of and may require an update to this RTV Plan would be an extensive wildfire occurring in the watershed.

Although habitat models other than what we used would alter estimates of the distribution and abundance of suitable habitat, the general corroboration with photo imagery and local knowledge of the ground, provide strong support that the foundation of the plan would remain unchanged if different models were used. However, if future data determines that these are sufficiently inaccurate and the RTV Plan misinforms delineations of habitat suitability now and in the future, then a revision to the RTV Plan may be appropriate. Climate change and plant disease may alter the distribution of red tree vole habitat, but any predictions on such changes would be naïve to make at this time. Fire has influenced connectivity of red tree vole habitat to adjacent watersheds (Figure 3) and it is reasonable to expect future fire occurrence within the watershed. The large extent of currently suitable habitat particularly in riparian drainages and north slopes provide resilience to stand replacement by fire. If a large portion of these areas were to burn in the future, the RTV Plan may be insufficient for providing a reasonable assurance of species persistence, and a review of this conservation plan would be warranted.

# XII. Literature Cited

Davis, R.J., B. Hollen, J. Hobson, J.E. Gower, D. Keenum. 2016. Northwest Forest Plan – the first 20 years (1994-2013): status and trends of northern spotted owl habitats. Gen. Tech. Rep. PNW-GTR-929. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 54 p.

Dunk, J. R., and J. J. Hawley. 2009. Red-tree vole habitat suitability modeling: implications for conservation and management. Forest Ecology and Management 258:626-634.

Forsman, E. D., J. K. Swingle, R. J. Davis, B. L. Biswell, and L. S. Andrews. 2016. Tree voles: an evaluation of their distribution and habitat relationships based on recent and historical studies, habitat models, and vegetation change. General Technical Report PNW-GTR-938. USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon, USA.

Huff, R. 2016. High-priority site management recommendations for the red tree vole (Arborimus longicaudus) - version 1.0 March 2016. Portland, OR: USDI Bureau of Land Management and USDA Region 6 Forest Service.

Huff, R., K. Van Norman, C. Hughes, et al. 2012. Survey protocol for the red tree vole, Version 3.0. Portland, OR: USDA Forest Service Region 5 and 6, USDI Bureau of Land Management Oregon/Washington. 52 p.

Linnell, M.A., R.J. Davis, D.B. Lesmeister, and J.K. Swingle. 2017. Conservation and relative habitat suitability for an arboreal mammal associated with old forest. Forest Ecology and Management 402:1–11.

Linnell, M.A., D.B. Lesmeister, J.D. Bailey, E.D. Forsman, and J.K. Swingle. 2018. Response of arboreal rodents to increased availability of nest substrates in young forests. Journal of Mammalogy 99:1174–1182.

USDA Forest Service. 1989. Land and Resource Management Plan - Siskiyou National Forest. Portland, OR: USDA Forest Service, Pacific Northwest Region.

USDA Forest Service; USDI Bureau of Land Management. 1994. [Northwest Forest Plan] Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl [and] standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, OR.

USDA Forest Service; USDI Bureau of Land Management. 2001. Record of decision and standards and guidelines for amendments to the survey and manage, protection buffer, and other mitigation measures standards and guidelines. Vol. 1. Portland, OR.

Van Norman, K. 2014. Unpublished notes from red tree vole meeting (Ray Davis, FS/BLM; Eric Forsman, FS PNW research lab; Rob Huff, FS/BLM; Carol Hughes, FS/BLM; Jimmy Swingle, Oregon State University; and Kelli Van Norman, FS/BLM). On file with; USDI Bureau of Land Management, Oregon State Office, 1220 SW 3rd Avenue, Portland OR 97204.

Personal Communication: Robert Barnhart, RRSNF Timber Program Manager, formerly the Wild Rivers Ranger District Silviculturalist, April 30, 2018.

# Attachments: Tables and Figures

Table 1. Acreage of land-use allocations, RTV Plan and suitable habitat within the Briggs Creek watershed.

| Spatial Unit | Total Acres | % of WS | % of Federal WS | Suitable Habitat Federal Acres (% total) |
|---|---|---|---|---|
| Briggs Creek Fifth Field Watershed | 43,726 | 100 | NA | 19,399 (44) |
| Federal management | 41,364 | 95 | 100 | 18,785 (45) |
| Total LSR, Riparian Reserve, Wild River | 24,149 | 55 | 58 | 11,287 (47) |
| Total Administratively withdrawn allocation (Backcountry Rec, Botanical Area, Special Wildlife Site, Scenic River) | 2,730 | 6 | 7 | 1,196 (44) |
| Total Matrix land use allocation | 14,485 | 33 | 35 | 6,302 (43) |
| Total Suitable RTV habitat on NF lands | 18,785 | 41 | 44 | 18,785 |
| RTV Plan within the watershed (LUA-RTV, Connectivity Areas, HPS) | **23,442** | **54** | **57** | **11,514 (49)** |
| Land-use allocations managed consistent for tree voles (LUA-RTV) not including small riparian reserves | 21,662 | 49 | 52 | 10,408 (48) |
| Connectivity corridors | 1,016 | 2 | 2 | 768 (76) |
| High Priority Sites | 764 | 2 | 2 | 638 (83) |
| Acres requiring pre-disturbance surveys | 7,898 | 18 | 19 | 2,476 (31) |
| Non-HPS (Total WA Federal minus HPS, LUA-RTV, Connectivity Areas, no pre-disturbance surveys required) | **10,189** | **23** | **25** | **4,610 (45)** |
| Matrix Non-RTV Plan | 7,214 | 16 | 17 | 3,386 (47) |
| NHP Riparian Reserve (small, with isolated habitat) | 1,061 | 2 | 2 | 381 (34) |
| Non-high priority sites in other LUA | 1,914 | 4 | 5 | 843 (44) |
| Serpentine Soils (national forest lands) | 6,689 | 15 | 16 | 1,118 |
| Serpentine in LUA-RTV | 5,013 | 11 | 12 | 990 |
| Serpentine in non-HPS | 1,697 | 4 | 4 | 139 |

Table 2. Characteristics of habitat and topography for the RTV Plan within the Briggs Creek watershed.

| Spatial Unit | Total Acres | Suitable Habitat Federal Acres (% total) | Acres forested 40-60% CC low contrast (% total) | Acres Aspect SE-S-SW-W (% total) | Acres Aspect NW-N-NE-E-Flat (% total) | Low RHS[1] ridgeline (% total) | High RHS low and mid-slope (% total) | Riparian Reserve (% total) |
|---|---|---|---|---|---|---|---|---|
| Briggs Creek Fifth Field Watershed | 43,726 | 19,399 (44) | 3,395 (8) | 23,515 (54) | 20,211 (46) | 17,363 (40) | 26,363 (60) | 11,011 (25) |
| Total Suitable RTV habitat on NF lands | 18,785 | 18,785 | | 16,791 (89) | 1,994 (11) | 4,432 (24) | 14,353 (76) | 10,079 (54) |
| Known RTV nest trees | 196 trees | 163 (83) | 6 (3) | 158 (81) | 38 (19) | 14 (7) | 182 (93) | 42 (21) |
| LUA-RTV (not including small riparian reserves) | 21,662 | 10,408 (48) | 1,854 (9) | 11,231 (52) | 10,431 (48) | 6,987 (32) | 14,675 (68) | 6,992 (32) |
| Connectivity corridors | 1,016 | 768 (76) | 65 (6) | 500 (49) | 516 (51) | 189 (19) | 827 (81) | 527 (52) |
| High Priority Sites | 764 | 638 (83) | 34 (4) | 508 (66) | 256 (34) | 212 (28) | 552 (72) | 98 (13) |
| HPS 1[2] | 11 | 11 | 0 | 11 | 0 | 0 | 11 | 0 |
| HPS 2 | 48 | 45 | 1 | 45 | 3 | 0 | 48 | 11 |
| HPS 3 | 36 | 34 | 1 | 28 | 8 | 0 | 36 | 0 |
| HPS 4 | 37 | 28 | 3 | 20 | 17 | 15 | 22 | 1 |
| HPS 5 | 16 | 13 | 1 | 16 | 0 | 0 | 16 | 0 |
| HPS 6 | 40 | 34 | 2 | 23 | 17 | 0 | 40 | 7 |
| HPS 7 | 23 | 21 | 0 | 12 | 11 | 0 | 23 | 13 |
| HPS 8 | 40 | 40 | 0 | 10 | 30 | 14 | 26 | 0 |
| HPS 9 | 45 | 38 | 3 | 36 | 9 | 0 | 45 | 6 |
| HPS 10 | 13 | 13 | 0 | 5 | 8 | 0 | 13 | 0 |
| HPS 11 | 32 | 15 | 5 | 29 | 3 | 3 | 29 | 0 |
| HPS 12 | 17 | 16 | 0 | 12 | 5 | 4 | 13 | 0 |
| HPS 13 | 17 | 17 | 0 | 16 | 1 | 0 | 17 | 0 |
| HPS 14 | 18 | 17 | 0 | 6 | 12 | 8 | 10 | 0 |
| HPS 15 | 32 | 24 | 3 | 8 | 24 | 3 | 29 | 20 |
| HPS 16 | 104 | 76 | 4 | 62 | 42 | 90 | 14 | 5 |
| HPS 17 | 32 | 25 | 2 | 21 | 11 | 0 | 32 | 8 |
| HPS 18 | 26 | 20 | 1 | 12 | 14 | 25 | 1 | 0 |
| HPS 19 | 45 | 40 | 2 | 36 | 9 | 12 | 33 | 10 |
| HPS 20 | 68 | 60 | 3 | 59 | 9 | 20 | 48 | 18 |
| HPS 21 | 37 | 32 | 1 | 34 | 3 | 18 | 19 | 0 |
| HPS 22 | 28 | 22 | 2 | 7 | 21 | 0 | 28 | 5 |

1 RHS – relative habitat suitability is the potential for a site to produce high value nesting/roosting habitat for northern spotted owls based on the environmental conditions of a site (Davis et al. 2016). These are usually some of the best site conditions for red tree vole habitat.

2 See Figure 7 for individual HPS locations.

Figure 2. Land-use allocations in Briggs Creek and within 2 miles of adjacent fifth-field watersheds. Riparian reserves within LSR, wilderness and wild river are managed to the more restrictive standards and guidelines of those allocations.

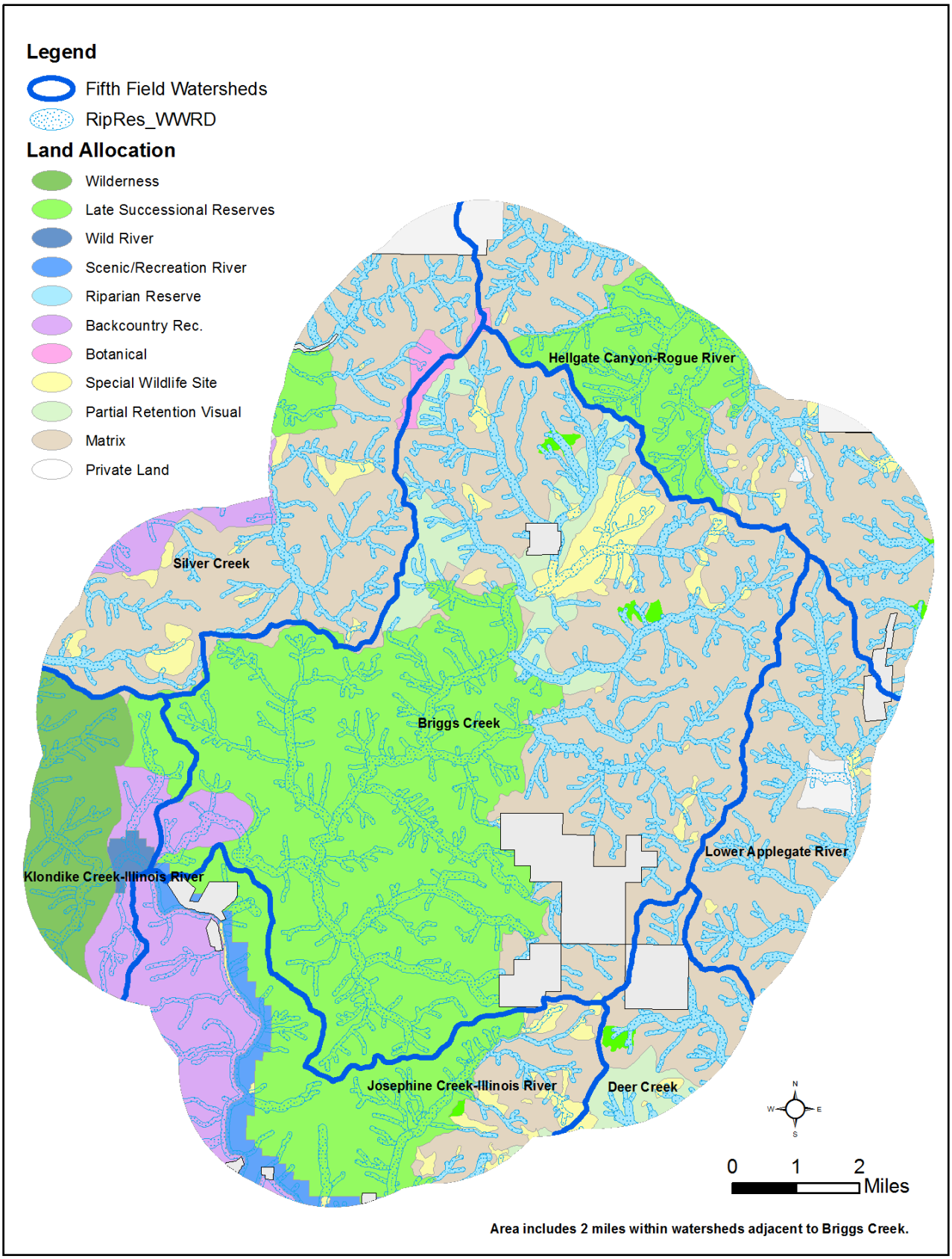

Figure 3. Fire history and serpentine soils in the Briggs Creek watershed

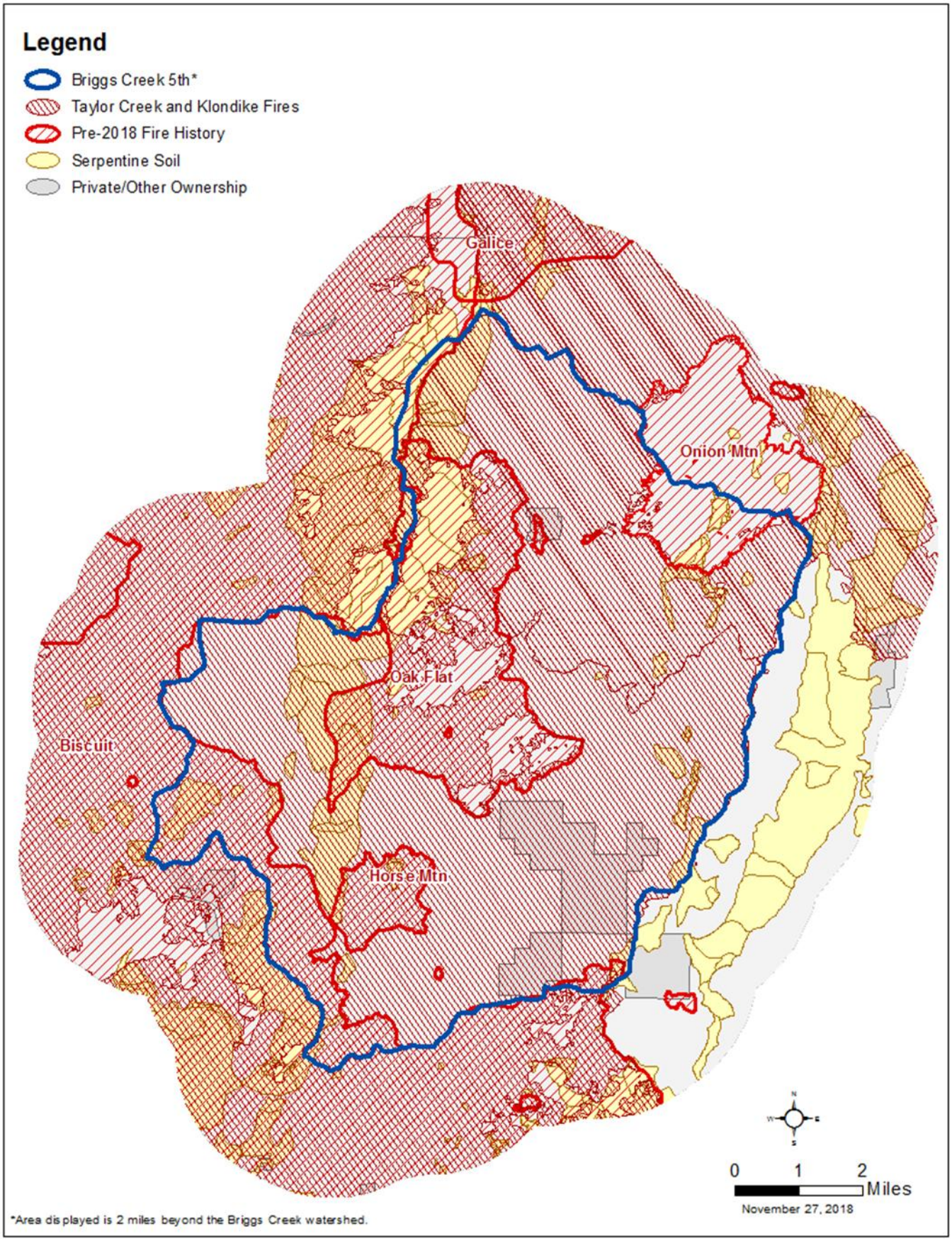

Figure 4. Serpentine soils and soil water storage in the Briggs Creek fifth-field watershed and within 2 miles of surrounding watersheds.

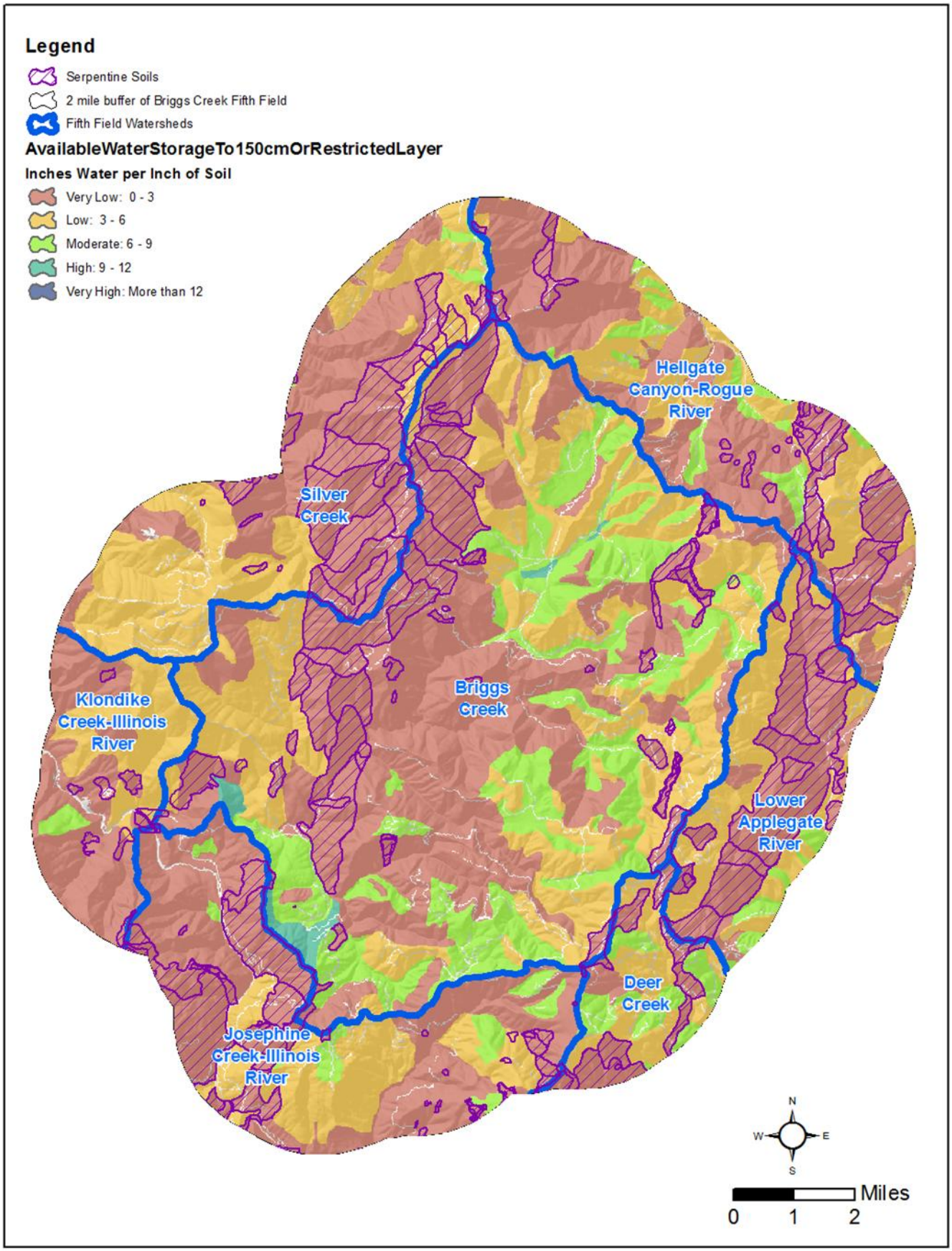

Figure 5. Suitable red tree vole habitat based on GNN updated with fire intensity data within Briggs Creek and adjacent watersheds.

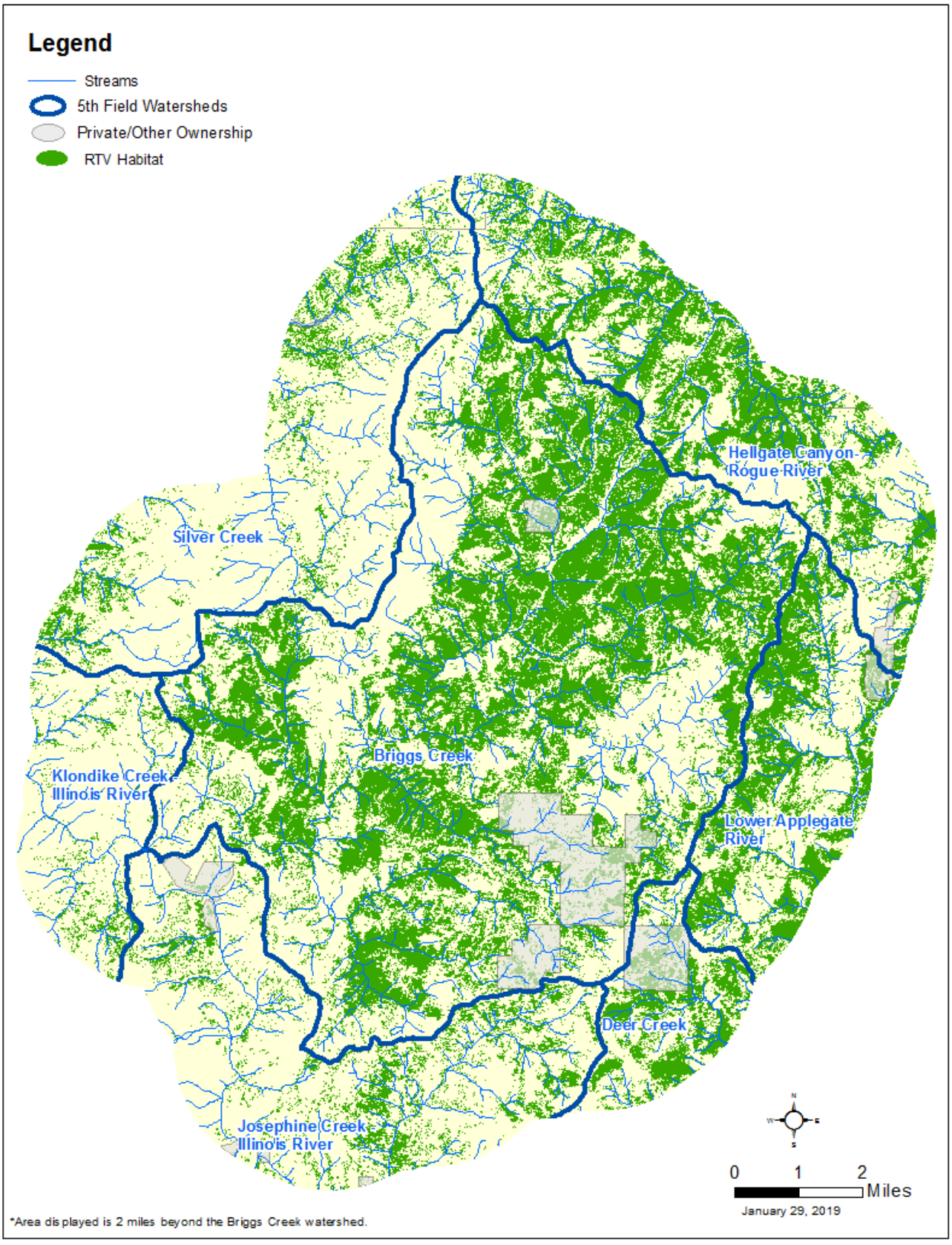

Figure 6. Red tree vole conservation plan (RTV Plan) within the Briggs Creek watershed and suitable habitat.

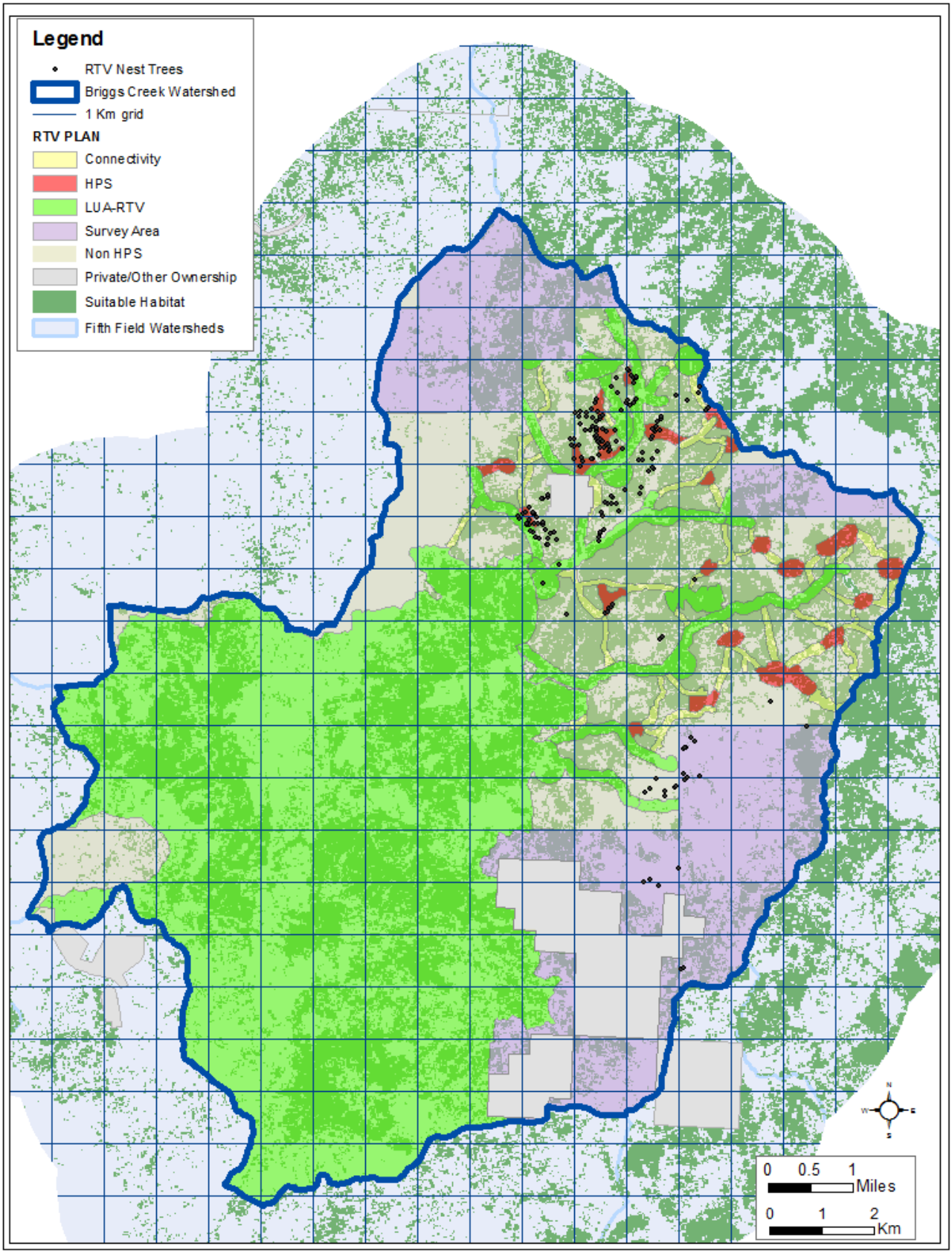

Figure 7. RTV Plan High Priority Sites and surrounding habitat within the Briggs Creek watershed. (NSO PFF = post-fire foraging habitat, NRF prior to the fires but burned with >50% basal area loss.)